

Spectrum Sharing Study

San Diego, CA



Prepared on Behalf of
Qualcomm
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1.0 Executive Summary

On behalf of Qualcomm, Comsearch has completed a Spectrum Sharing Study in San Diego, CA to identify any active 2.1 GHz microwave links that may receive interference by the proposed devices that will be temporarily operating in 2155 - 2180 MHz. Comsearch utilized specific site information provided by Qualcomm for the study. Interference calculations were made based on this cell layout using our proprietary microwave database of incumbent systems. The results of this study determine the availability of the spectrum and identify any predicted victim microwave links.

Summary of Results

	2155 – 2180 MHz
Links considered in analysis	133
Co-channel microwave links	25
Adjacent channel microwave links	108
Licensed 2.1 GHz victim links	0*

Qualcomm's system will not create harmful interference into active 2.1 GHz MW Links, provided that the following site parameters are used:

Site Name	Sector	Azimuth	Height	EIRP	Antenna	Downtilt
AR	1	0	30	61.14	742215_2170_M45pol	0
AR	2	120	30	61.14	742215_2170_M45pol	0
AR	3	240	30	61.14	742215_2170_M45pol	0
AT	1	60	50	61.14	742215_2170_M45pol	0
AT	2	180	50	61.14	742215_2170_M45pol	0
AT	3	300	50	61.14	742215_2170_M45pol	0
A	1	30	7.6	61.14	742215_2170_M45pol	0
A	2	150	7.6	61.14	742215_2170_M45pol	0
A	3	270	7.6	61.14	742215_2170_M45pol	0
E	1	90	18.3	61.14	742215_2170_M45pol	0
E	2	210	18.3	61.14	742215_2170_M45pol	0
E	3	330	18.3	61.14	742215_2170_M45pol	0

2.0 Parameters and Assumptions

Spectrum Allocation

This study analyzed the use of frequencies 2155 – 2180 MHz.

Study Area

The study was conducted using 4 sites provided by Qualcomm and located in the San Diego, CA market. All microwave links within the Bulletin 10-F derived coordination contour and within ± 20 MHz of the band edges of the spectrum block were analyzed for potential interference.

Parameters

Number of Sites	4
Base Station EIRP	61.1 dBm
Max BTS Cell Size (Radius)	5 kilometers
Antenna used	Directional Antenna
Frequency Division Duplex	Base Station Transmit at 2.1 GHz
Bandwidth of system	Variable – up to 20 MHz

Interference Criteria

Propagation Model	OH Loss (base)
Analog Interference Criteria (C/I)	Threshold Degradation and Baseband Noise
Noise Objective	25 pWpO
Digital Interference Criteria	Receiver Threshold - T/I
Excess Fade Margin Based on	99.999% Link Reliability
Polarization	Co-polarization

3.0 Analysis Results

Summary of Results

A table summarizing the microwave links that were analyzed is provided in Appendix B. Qualcomm will not cause interference into any of these microwave links provided that the sites operate using direction antennas oriented appropriately.

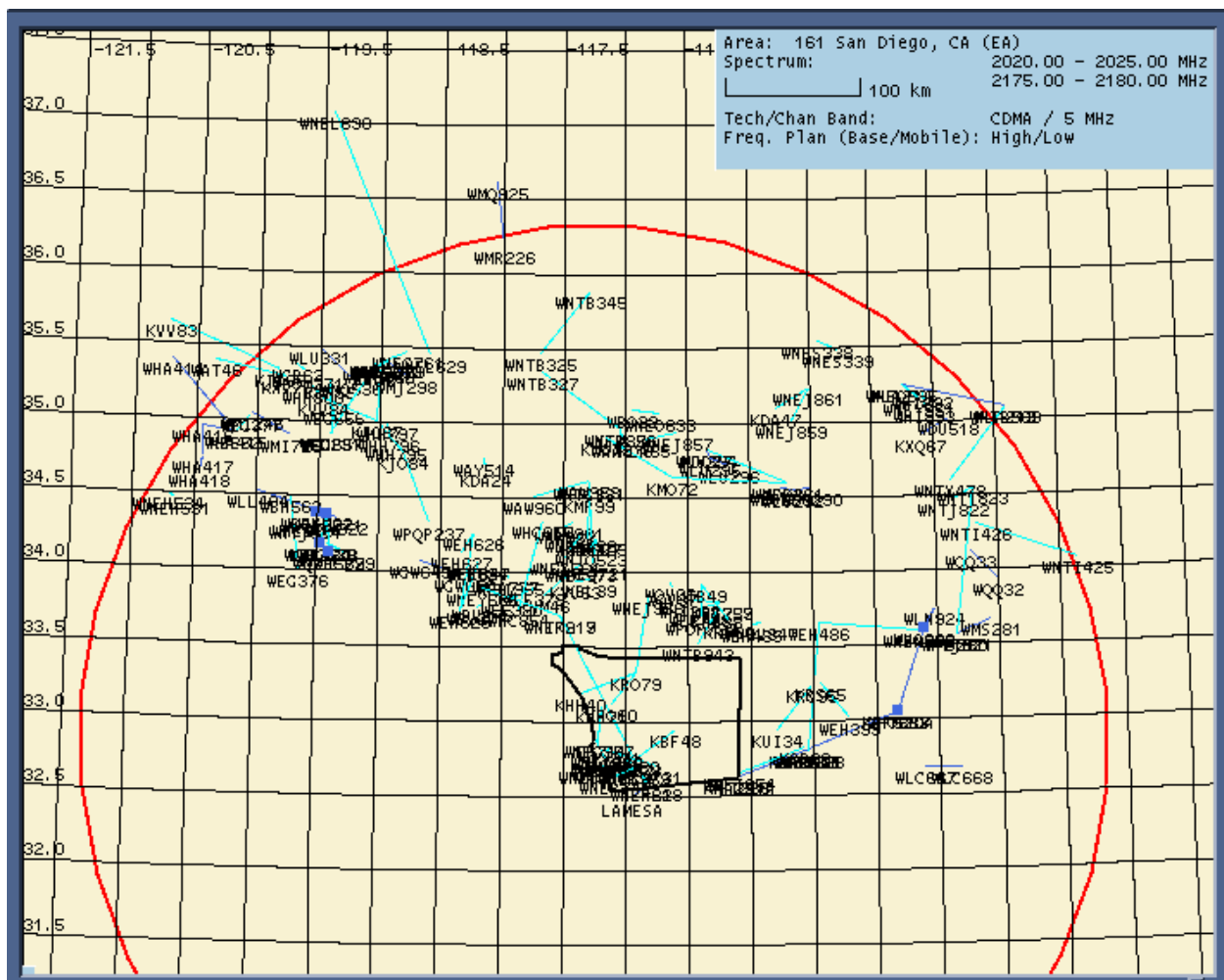
Microwave Data

The reports in the Appendices contain status information for each link. The various statuses are defined as follows:

- Licensed - Licensed with the Federal Communications Commission (FCC).
- Replaced - Licensed with the FCC but a new application has been filed to replace the existing path. Once the new path becomes licensed by the FCC, the status changes to Relocated.
- Relocated – Within the 18-month build out period for a new license on a different frequency band.
- Expired – Past the FCC expiration date and no renewal filed.
- Operating - Confirmed by licensee to be operating, but actual site data does not match FCC license.
- Questionable - One side of the path is listed as licensed with the FCC while the other end has been canceled or expired. This occurs because the FCC maintains licenses by transmit site rather than by path.
- Secondary - Operating in a secondary capacity based on FCC special conditions.

The various microwave path statuses are maintained to most accurately describe the state of transition that the microwave path may be in at any given time. Further investigation into the application history of specific paths may be necessary to establish a final determination on its license validity.

APPENDIX A:
Coordination Contour



APPENDIX B:
Microwave Paths Analyzed

Link ID	Call Signs	RxFreq	Status	Owner
210119810	WLB210 WHA416	2126.8 2176.8	Expired Expired	Arch Wireless License Co LLC
210119850	WGX322 WLL404	2174 2124	Expired Questionable	Arch Wireless License Co LLC
210121000	WHA415 WHA416	2114.6 2164.6	Questionable Expired	Arch Wireless License Co LLC
210121010	WHA417 WHA416	2120.4 2170.4	Questionable Expired	Arch Wireless License Co LLC
210415950	WGW650 WGW645	2171.6 2121.6	Licensed Secondary	Arch Wireless License Co LLC
211475400	WHA418 WHA417	2163.6 2113.6	Licensed Licensed	Arch Wireless License Co LLC
220089010	KMR97 KMR99	2181.6 2131.6	Licensed Licensed	BNSF Railway Company
220078630	WNTB777 WNEE308	2191.2 2141.2	Expired Questionable	Dos Cuadras Offshore Resources
220078710	WNTB777 KEP29	2184 2134	Expired Expired	Dos Cuadras Offshore Resources
220078720	WNTB776 WNEE308	2147.6 2197.6	Expired Questionable	Dos Cuadras Offshore Resources
220093130	WHC680 WAL383	2184 2134	Expired Expired	Dos Cuadras Offshore Resources
220093300	WGY715 WNEH878	2184.8 2134.8	Expired Expired	Dos Cuadras Offshore Resources
220093350	WHC676 WHC677	2194.4 2144.4	Licensed Licensed	Dos Cuadras Offshore Resources
220093360	WHC678 WHC676	2141.2 2191.2	Licensed Licensed	Dos Cuadras Offshore Resources
220093370	WED359 WHC679	2146.8 2196.8	Expired Expired	Dos Cuadras Offshore Resources
220093380	WHC679 WHC678	2188.8 2138.8	Expired Questionable	Dos Cuadras Offshore Resources
220093390	WHC677 WHC680	2142.8 2192.8	Questionable Expired	Dos Cuadras Offshore Resources
220093470	WHC680 WNTJ924	2180.8 2130.8	Expired Questionable	Dos Cuadras Offshore Resources
220093480	WNTJ924 WNTJ923	2142 2192	Licensed Licensed	Dos Cuadras Offshore Resources
220094220	WNEH878 WNEH879	2146 2196	Expired Questionable	Dos Cuadras Offshore Resources
211730760	KLF520A KLF520B	2178 2128	Licensed Licensed	Fisher Wireless Services Inc.
210080130	WQQ33 WQQ32	2115.2 2165.2	Licensed Licensed	Verizon California Inc.
210111180	WLC826 WLC827	2165.2 2115.2	Expired Expired	Verizon California Inc.
210119880	KMU48 KNE70	2168.4 2118.4	Relocated Expired	Verizon California Inc.
210119900	KYO72 KYO73	2176.8 2126.8	Expired Expired	Verizon California Inc.
210082360	WMN364 WHA708	2178 2128	Relocated Relocated	Los Angeles SMSA Ltd. Partnership
210637110	WMJ338 WMJ339	2121.6 2171.6	Replaced Replaced	New Cingular Wireless PCS - Los Angeles
210720280	WLV431 WPNG335	2128 2178	Relocated Relocated	New Cingular Wireless PCS - Los Angeles
220061160	KQP29 WSJ37	2197.6 2147.6	Licensed Licensed	California State of
220061330	KBF48 KDC78	2184.8 2134.8	Licensed Licensed	California State of
220061390	KBF48 WLH23	2197.6 2147.6	Licensed Licensed	California State of

220061460	WNEJ954 KQP29	2138 2188	Licensed Licensed	California State of
220075280	KHH88 WNTB943	2134 2184	Licensed Licensed	California State of
220075310	KRO79 WNEJ956	2186.4 2136.4	Licensed Licensed	California State of
220076310	KDD86 WHJ600	2196.8 2146.8	Licensed Licensed	California State of
220076410	KRO79 KHH40	2181.6 2131.6	Licensed Licensed	California State of
220076570	WAA777 WNEJ955	2186.4 2136.4	Licensed Licensed	California State of
220076660	KRO79 KRO80	2189.6 2139.6	Licensed Licensed	California State of
220087970	WDQ26 WDQ27	2133.2 2183.2	Licensed Licensed	California State of
220088180	WDQ27 KFW85	2199.2 2149.2	Licensed Licensed	California State of
220088190	KFW85 KFW86	2145.2 2195.2	Licensed Licensed	California State of
220088260	WPN99 KFW85	2192 2142	Licensed Licensed	California State of
220088790	KFW85 WAA875	2135.6 2185.6	Licensed Licensed	California State of
220089040	KDG27 WNEQ721	2189.6 2139.6	Licensed Licensed	California State of
220089120	KDG27 WNTQ523	2181.6 2131.6	Questionable Expired	California State of
220090460	WAA774 WAA776	2195.2 2145.2	Licensed Licensed	California State of
220090840	KMP22 WBH557	2147.6 2197.6	Licensed Licensed	California State of
220093150	KBH20 WHH502	2191.2 2141.2	Licensed Licensed	California State of
220093160	WHI665 KBH20	2149.2 2199.2	Licensed Licensed	California State of
220093290	KQP30 WED231	2130.8 2180.8	Licensed Licensed	California State of
220277320	KCI38 WQU85	2192.8 2142.8	Licensed Licensed	California State of
220060680	WEH399 WAH762	2147.6 2197.6	Licensed Licensed	COACHELLA VALLEY COUNTY WATER DISTRICT
220074700	KRS65 WEH399	2184.8 2134.8	Licensed Licensed	COACHELLA VALLEY COUNTY WATER DISTRICT
220075190	WPOP729 WPOP727	2194.4 2144.4	Secondary Secondary	COACHELLA VALLEY COUNTY WATER DISTRICT
220075290	WQV36 WQV37	2184.8 2134.8	Licensed Licensed	COACHELLA VALLEY COUNTY WATER DISTRICT
220075300	WQV37 KTB49	2141.2 2191.2	Licensed Licensed	COACHELLA VALLEY COUNTY WATER DISTRICT
220075340	KRS60 WPOP728	2133.2 2183.2	Relocated Relocated	COACHELLA VALLEY COUNTY WATER DISTRICT
220075370	KTB49 KRS60	2188 2138	Licensed Licensed	COACHELLA VALLEY COUNTY WATER DISTRICT
220454080	KTB49 WPOP727	2181.6 2131.6	Licensed Secondary	COACHELLA VALLEY COUNTY WATER DISTRICT
220454100	WPOP728 WPOR792	2194.4 2144.4	Secondary Secondary	COACHELLA VALLEY COUNTY WATER DISTRICT
221546300	KRS58 KRS59	2147.6 2197.6	Questionable Expired	COACHELLA VALLEY COUNTY WATER DISTRICT
220088020	WNEK461 WNTR252	2147.6 2197.6	Licensed Licensed	Pacific Gas and Electric Company
220093420	KCW68 KMS80	2149.2 2199.2	Licensed Licensed	Pacific Gas and Electric Company

220527300	KMO73 KMO72	2133.2 2183.2	Licensed Licensed	Pacific Gas and Electric Company
220527310	WNEK461 KMO72	2136.4 2186.4	Licensed Licensed	Pacific Gas and Electric Company
220062000	WEF711 WEF712	2188 2138	Licensed Licensed	Regents of the University of California
220061410	KMX31 WNTJ820	2186.4 2136.4	Licensed Licensed	SAN DIEGO COUNTY
220061440	WNEG959 WNEG960	2183.2 2133.2	Questionable Expired	SAN DIEGO COUNTY
220062020	KFM56 WNEG956	2146 2196	Licensed Licensed	SAN DIEGO COUNTY
220062030	WGY831 WNEG957	2142.8 2192.8	Licensed Licensed	SAN DIEGO COUNTY
220062050	WNEG955 KFM56	2181.6 2131.6	Licensed Licensed	SAN DIEGO COUNTY
220062060	WNEG956 WGY831	2186.4 2136.4	Licensed Licensed	SAN DIEGO COUNTY
220062070	KHH71 WNEG957	2134.8 2184.8	Licensed Licensed	SAN DIEGO COUNTY
220062090	WNEP742 WNEG955	2144.4 2194.4	Licensed Licensed	SAN DIEGO COUNTY
220062100	WNEG959 WNEP742	2189.6 2139.6	Licensed Licensed	SAN DIEGO COUNTY
220497970	WPNC669 WPNH207	2186.4 2136.4	Relocated Relocated	SAN DIEGO COUNTY
220061990	WAQ662 WNEU813	2130.8 2180.8	Licensed Licensed	SAN DIEGO TRANSIT CORPORATION
211824700	WNEH623 LAMESA	2122.5 2178.5	Licensed Licensed	San Diego Gas and Electric
220076520	KMX72 KML35	2132.4 2182.4	Expired Expired	Southern California Edison Company
220078620	KMQ83 KMX91	2133.2 2183.2	Expired Expired	Southern California Edison Company
220089080	WNEZ561 WNEU422	2189.6 2139.6	Questionable Questionable	Southern California Edison Company
220061170	KRG95 KUI34	2137.2 2187.2	Licensed Licensed	Union Pacific Railroad Company
220076470	KDA49 KHM46	2141.2 2191.2	Licensed Licensed	Union Pacific Railroad Company
220076480	KHM46 WNEG973	2184.8 2134.8	Licensed Licensed	Union Pacific Railroad Company
220078610	KHM46 WJU41	2199.5 2149.5	Licensed Licensed	Union Pacific Railroad Company
220088170	KDA55 WNEJ857	2134.8 2184.8	Licensed Licensed	Union Pacific Railroad Company
220088800	WAW958 WAW959	2194.4 2144.4	Licensed Licensed	Union Pacific Railroad Company
220088810	WAW958 WAW960	2189.6 2139.6	Licensed Licensed	Union Pacific Railroad Company
220088820	WAW958 WAW961	2199.2 2149.2	Licensed Licensed	Union Pacific Railroad Company
220088830	WAW961 WAW962	2131.6 2181.6	Licensed Licensed	Union Pacific Railroad Company
220089140	WAW955 KRG90	2199.2 2149.2	Licensed Licensed	Union Pacific Railroad Company
220090470	KDA26 WAW957	2144.4 2194.4	Licensed Licensed	Union Pacific Railroad Company
220090480	WAY513 KDA24	2149.2 2199.2	Licensed Licensed	Union Pacific Railroad Company
220090500	KDA24 WAY514	2181.6 2131.6	Licensed Licensed	Union Pacific Railroad Company
220103530	KDA47 WNEJ861	2131.6 2181.6	Licensed Licensed	Union Pacific Railroad Company

220103540	KDA47 WNEJ383	2146 2196	Licensed Licensed	Union Pacific Railroad Company
220103620	WNEJ859 WNEJ861	2139.6 2189.6	Licensed Licensed	Union Pacific Railroad Company
220104190	KDA26 WGX629	2141.2 2191.2	Licensed Licensed	Union Pacific Railroad Company
220283240	KDA58 WNEJ860	2142.8 2192.8	Licensed Licensed	Union Pacific Railroad Company
220359540	WED404 WED405	2194.4 2144.4	Relocated Relocated	Union Pacific Railroad Company
220506610	KDA47 WNEJ858	2142.8 2192.8	Licensed Licensed	Union Pacific Railroad Company
220061140	WNTA550 WNEF998	2197.6 2147.6	Licensed Licensed	IMPERIAL IRRIGATION DISTRICT
220075220	WNEG203 WNET265	2149.2 2199.2	Licensed Licensed	IMPERIAL IRRIGATION DISTRICT
220075240	WNTF535 WNEG203	2196 2146	Licensed Licensed	IMPERIAL IRRIGATION DISTRICT
220369470	WNEF998 WNEF995	2134.8 2184.8	Secondary Secondary	IMPERIAL IRRIGATION DISTRICT
220076340	WEE380 WEE379	2184 2134	Licensed Licensed	ANAHEIM CITY COMMUNICATIONS DIVISION
220061430	WNEF219 WNEF218	2136.4 2186.4	Licensed Licensed	MATHENY RICHARD K
220076560	WNEF219 WNEF217	2141.2 2191.2	Licensed Licensed	MATHENY RICHARD K
220088910	WHC855 WHC856	2142.8 2196.8	Licensed Licensed	MATHENY RICHARD K
220311210	WNEL629 WHC855	2196.8 2142.8	Licensed Licensed	MATHENY RICHARD K
220311220	WHC856 WHJ984	2194.4 2144.4	Licensed Licensed	MATHENY RICHARD K
220311340	WNEL629 WNEL630	2188 2138	Licensed Licensed	MATHENY RICHARD K
220445560	WHC854 WHC855	2186.4 2136.4	Licensed Licensed	MATHENY RICHARD K
220333690	WPOT520 WPOT521	2184 2134	Secondary Secondary	NEWMONT MINING CORPORATION
220076380	WEH626 WEH628	2148.4 2198.4	Questionable Expired	LOS ANGELES UNIFIED SCHOOL DISTRICT
220078460	WEH625 WEE647	2181.6 2131.6	Licensed Licensed	LOS ANGELES UNIFIED SCHOOL DISTRICT
220078470	WEH625 WEH626	2188 2138	Licensed Licensed	LOS ANGELES UNIFIED SCHOOL DISTRICT
220090550	WEE647 WEH627	2146.8 2196.8	Licensed Licensed	LOS ANGELES UNIFIED SCHOOL DISTRICT
220090590	WEE647 WEH624	2135.6 2185.6	Licensed Licensed	LOS ANGELES UNIFIED SCHOOL DISTRICT
220090600	WEH627 WEH626	2185.6 2135.6	Licensed Licensed	LOS ANGELES UNIFIED SCHOOL DISTRICT
220287100	WEH626 WNTV524	2148.4 2198.4	Licensed Licensed	LOS ANGELES UNIFIED SCHOOL DISTRICT
220089100	WNTG383 WNTG381	2147.6 2197.6	Licensed Licensed	J DOERING COMMUNICATIONS
220089110	WNTG381 WNTG405	2188 2138	Licensed Licensed	J DOERING COMMUNICATIONS
220359250	WNTF775 WNTG405	2195.2 2145.2	Licensed Licensed	J DOERING COMMUNICATIONS
211818900	KMA251A KMA251B	2174.8 2124.8	Licensed Licensed	SOUTHERN MESSAGE SERVICE INC.
210056180	WHT232 WHT235	2174.8 2124.8	Questionable Questionable	WWC License L.L.C.
210080110	WHO886 WLN924	2168.4 2118.4	Licensed Licensed	WWC License L.L.C.

210080120	WHT233 WHO886	2124.8 2174.8	Licensed Licensed	WWC License L.L.C.
210430060	WMQ925 WMR226	2178 2128	Relocated Relocated	WWC License L.L.C.
210466640	WMS280 WMS281	2174.8 2124.8	Licensed Licensed	WWC License L.L.C.
211190680	WHO887 WHO886	2124.8 2174.8	Expired Questionable	WWC License L.L.C.
211555440	WLC668 WLC667	2160.8 2110.8	Questionable Questionable	WWC License L.L.C.
211673200	WMQ925 WMR226	2178 2128	Questionable Questionable	WWC License L.L.C.